

7212

BEAM POWER TUBE

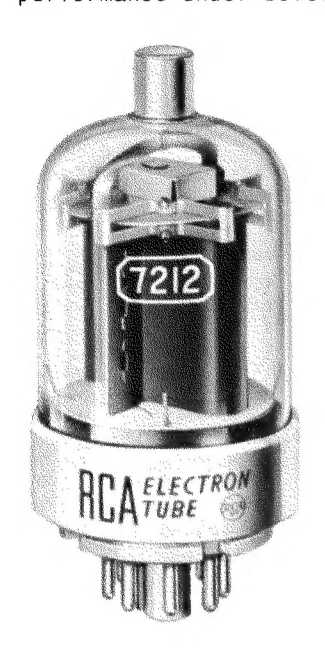
Small Size
High Power Gain
T-12 Bulb

For Use Under Severe Shock and Vibration
90 Watts CW Input (ICAS) up to 60 Mc
60 Watts CW Input (ICAS) at 175 Mc

TENTATIVE DATA

3-13/16" Max. Length
1-21/32" Max. Diameter
Octal 8-Pin Base

RCA-7212 is a small beam power tube designed specifically for applications where dependable performance under severe shock and vibration is essential. It is intended for use as an rf power amplifier and oscillator as well as an af power amplifier and modulator.



The 7212 has a maximum plate dissipation of 25 watts under ICAS conditions in modulator service and in cw service. In the latter service, it can be operated with full input to 60 Mc and with reduced input to 175 Mc.

Because of its high power gain and high efficiency, the 7212 can be operated with relatively low plate voltage to give large power output with small driving power.

Small in size for its power-output capability, the 7212 has a rugged button-stem construction with short internal leads, a T-12 bulb, triple base-pin connections for grid No.3 and cathode (both joined to internal shield inside the tube) to permit effective rf grounding, and a small-wafer octal base with metal sleeve having its own base-pin terminal. The sleeve shields the input to the tube and isolates it from the output circuit so completely that no other external shielding is required. Separation of input and output circuits is accomplished by bringing the plate lead out of the bulb to a cap opposite the base.

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	1.25	amperes
Transconductance, for plate volts = 200, grid-No.2 volts = 200, and plate ma. = 100.	7000	µmhos
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 200, grid-No.2 volts = 200, and plate ma. = 100. .	4.5	
Direct Interelectrode Capacitances:*		
Grid No.1 to plate	0.24 max.	µµf
Grid No.1 to cathode & grid No.3 & internal shield, base sleeve, grid No.2, and heater.	13.5	µµf
Plate to cathode & grid No.3 & internal shield, base sleeve, grid No.2, and heater.	8.5	µµf

Mechanical:

Operating Position	Any
Maximum Overall Length	3-13/16"
Seated Length.	3-1/8" ± 1/8"
Maximum Diameter	1-21/32"
Bulb	T-12
Cap.	Small (JETEC No.C1-1)
Socket	Standard Octal 8-Contact
Base	Small Micanol-Wafer Octal 8-Pin "770" Sleeve (JETEC Group 1, No.B8-150)
Bulb Temperature (At hottest point).	220 max. °C
Weight (Approx.)	2 oz

AF POWER AMPLIFIER & MODULATOR--Class AB$_1$†

Triode Connection--Grid No.2 Connected to Plate

Maximum Ratings, *Absolute Values:*

	CCS●	*ICAS*●●	
DC PLATE VOLTAGE	400 max.	400 max.	volts
MAX.-SIGNAL DC PLATE CURRENT**	90 max.	90 max.	ma
MAX.-SIGNAL PLATE INPUT**.	35 max.	35 max.	watts
PLATE DISSIPATION**. . . .	20 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode . .	135 max.	135 max.	volts
Heater positive with respect to cathode . .	135 max.	135 max.	volts

Typical Operation:

Values are for 2 tubes

DC Plate Voltage	250	400	400	volts
DC Grid-No.1 Voltage . . .	-50	-100	-100	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage° . . .	100	200	200	volts
Zero-Signal DC Plate Current.	120	40	40	ma

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7212 5-58
Printed in U.S.A.

Typical Operation (Cont'd):

	CCS●		ICAS●	
Max.-Signal DC Plate Current.	125	100	100	ma
Effective Load Resistance (Plate to plate)	5000	8000	8000	ohms
Max.-Signal Driving Power (Approx.).	0	0	0	watts
Max.-Signal Power Output (Approx.)	10	22	22	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1 Circuit Resistance under Any Condition:○○✠

With fixed bias.	0.1 max.	megohm
With cathode bias.	0.5 max.	megohm

AF POWER AMPLIFIER & MODULATOR--Class AB_1†

Maximum Ratings, *Absolute Values:*

	CCS●	ICAS●●	
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE.	250 max.	250 max.	volts
MAX.-SIGNAL DC PLATE CURRENT**.	125 max.	135 max.	ma
MAX.-SIGNAL PLATE INPUT**. .	60 max.	85 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT**.	3 max.	3 max.	watts
PLATE DISSIPATION**.	20 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode . . .	135 max.	135 max.	volts
Heater positive with respect to cathode . . .	135 max.	135 max.	volts

Typical CCS Operation:

Values are for 2 tubes

DC Plate Voltage	400	500	600	volts
DC Grid-No.2 Voltage▲.	190	185	180	volts
DC Grid-No.1 (Control-Grid) Voltage:				
With fixed-bias source . . .	-40	-40	-45	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage.	80	80	90	volts
Zero-Signal DC Plate Current .	63	57	26	ma
Max.-Signal DC Plate Current .	228	215	200	ma
Zero-Signal DC Grid-No.2 Current.	2.5	2	1	ma
Max.-Signal DC Grid-No.2 Current.	25	25	23	ma
Effective Load Resistance (Plate to plate)	4000	5500	7000	ohms
Max.-Signal Driving Power (Approx.).	0	0	0	watts
Max.-Signal Power Output (Approx.).	55	70	82	watts

Typical ICAS Operation:

Values are for 2 tubes

DC Plate Voltage	600	750	volts
DC Grid-No.2 Voltage▲.	200	195	volts
DC Grid-No.1 (Control-Grid) Voltage:			
From fixed-bias source	-50	-50	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage.	100	100	volts
Zero-Signal DC Plate Current . . .	28	23	ma
Max.-Signal DC Plate Current . . .	229	220	ma
Zero-Signal DC Grid-No.2 Current .	1	1	ma
Max.-Signal DC Grid-No.2 Current .	27	26	ma
Effective Load Resistance (Plate to plate)	6000	8000	ohms
Max.-Signal Driving Power (Approx.).	0	0	watts
Max.-Signal Power Output (Approx.).	95	120	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance under Any Condition:○○♣

With fixed bias.	0.1 max.	megohm
With cathode bias.	Not recommended	

AF POWER AMPLIFIER & MODULATOR--Class AB_2#

Maximum Ratings, *Absolute Values:*

	CCS●	ICAS●●	
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE.	250 max.	250 max.	volts
MAX.-SIGNAL DC PLATE CURRENT**.	125 max.	135 max.	ma
MAX.-SIGNAL PLATE INPUT**. .	62.5 max.	90 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT**.	3 max.	3 max.	watts
PLATE DISSIPATION**.	20 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode . . .	135 max.	135 max.	volts
Heater positive with respect to cathode . . .	135 max.	135 max.	volts

Typical CCS Operation:

Values are for 2 tubes

DC Plate Voltage	400	500	600	volts
DC Grid-No.2 Voltage▲.	175	175	165	volts
DC Grid-No.1 (Control-Grid) Voltage:				
From fixed-bias source	-41	-44	-44	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage.	95	102	97	volts
Zero-Signal DC Plate Current . .	33	27	22	ma
Max.-Signal DC Plate Current . .	232	242	207	ma
Zero-Signal DC Grid-No.2 Current	1.1	0.7	0.6	ma
Max.-Signal DC Grid-No.2 Current	18	18	17	ma
Max.-Signal DC Grid-No.1 Current	1.6	1.9	1.1	ma
Effective Load Resistance (Plate to plate)	3700	4600	6800	ohms
Max.-Signal Driving Power (Approx.)♦	0.2	0.3	0.2	watt
Max.-Signal Power Output (Approx.).	62	83	90	watts

Typical ICAS Operation:

Values are for 2 tubes

DC Plate Voltage	600	750	volts
DC Grid-No.2 Voltage▲.	190	165	volts
DC Grid-No.1 (Control-Grid) Voltage:			
From fixed-bias source	-48	-46	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage.	109	108	volts
Zero-Signal DC Plate Current . . .	28	22	ma
Max.-Signal DC Plate Current . . .	270	240	ma
Zero-Signal DC Grid-No.2 Current .	1.2	0.3	ma
Max.-Signal DC Grid-No.2 Current .	20	20	ma
Max.-Signal DC Grid-No.1 Current .	2	2.6	ma
Effective Load Resistance (Plate to plate)	5000	7400	ohms
Max.-Signal Driving Power (Approx.)♦	0.3	0.4	watt
Max.-Signal Power Output (Approx.)	113	131	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance:♦

With fixed bias.	30000 max.	ohms
With cathode bias.	Not recommended	

PLATE-MODULATED RF POWER AMPLIFIER--Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values:*

	CCS●	ICAS●●	
DC PLATE VOLTAGE	480 max.	600 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	250 max.	250 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-150 max.	-150 max.	volts
DC PLATE CURRENT	117 max.	125 max.	ma
DC GRID-No.1 CURRENT	3.5 max.	4.0 max.	ma
PLATE INPUT	45 max.	67.5 max.	watts
GRID-No.2 INPUT	2 max.	2 max.	watts
PLATE DISSIPATION	13.3 max.	16.7 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts

Typical Operation up to 60 Mc:

	CCS	CCS	ICAS	
DC Plate Voltage	400	475	600	volts
DC Grid-No.2 Voltage♦	150	135	150	volts
From a series resistor of	33000	51000	56000	ohms
DC Grid-No.1 Voltage★	-87	-77	-87	volts
From a grid resistor of	27000	27000	27000	ohms
Peak RF Grid-No.1 Voltage	107	95	107	volts
DC Plate Current	112	94	112	ma
DC Grid-No.2 Current	7.8	6.4	7.8	ma
DC Grid-No.1 Current (Approx.)	3.4	2.8	3.4	ma
Driving Power (Approx.)	0.4	0.3	0.4	watt
Power Output (Approx.)	32	34	52	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance‡ . . . . 30000 max. ohms

RF POWER AMPLIFIER & OSC.--Class C Telegraphy□ and RF POWER AMPLIFIER--Class C FM Telephony

Maximum Ratings, *Absolute Values:*

	CCS●	ICAS●●	
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	250 max.	250 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-150 max.	-150 max.	volts
DC PLATE CURRENT	140 max.	150 max.	ma
DC GRID-No.1 CURRENT	3.5 max.	4.0 max.	ma
PLATE INPUT	67.5 max.	90 max.	watts
GRID-No.2 INPUT	3 max.	3 max.	watts
PLATE DISSIPATION	20 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts

Typical Operation as Amplifier up to 60 Mc:

	CCS●	CCS●	ICAS●	ICAS●	
DC Plate Voltage	500	600	600	750	volts
DC Grid-No.2 Voltage⊕⊕	170	150	180	160	volts
From a series resistor of	36000	51000	43000	56000	ohms
DC Grid-No.1 Voltage■	-66	-58	-71	-62	volts
From a grid-No.1 resistor of	27000	20000	24000	20000	ohms
From a cathode resistor of	470	470	430	470	ohms
Peak RF Grid-No.1 Voltage	84	73	91	79	volts
DC Plate Current	135	112	150	120	ma
DC Grid-No.2 Current	9	9	10	11	ma
DC Grid-No.1 Current (Approx.)	2.5	2.8	2.8	3.1	ma
Driving Power (Approx.)	0.2	0.2	0.3	0.2	watt
Power Output (Approx.)	48	52	66	70	watts

Typical Operation as Amplifier at 175 Mc:

	CCS	ICAS	
DC Plate Voltage	320	400	volts
DC Grid-No.2 Voltage⊕⊕	180	190	volts
From a series resistor of	13000	20000	ohms
DC Grid-No.1 Voltage■	-51	-54	volts
From a grid resistor of	27000	24000	ohms
From a cathode resistor of	330	330	ohms
Peak RF Grid-No.1 Voltage	64	68	volts
DC Plate Current	140	150	ma
DC Grid-No.2 Current	10	10.4	ma
DC Grid-No.1 Current (Approx.)	2	2.2	ma
Driving Power (Approx.)	3	3	watts
Power Output (Approx.)	25	35	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1 Circuit Resistance‡ . . . . 30000 max. ohms

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	1.175	1.325	amperes
Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	–	0.24	μμf
Grid No.1 to cathode & grid No.3 & internal shield, base sleeve, grid No.2, and heater	2	12.0	15.0	μμf
Plate to cathode & grid No.3 & internal shield, base sleeve, grid No.2, and heater	2	7.3	9.5	μμf
Plate Current	3	46	94	ma
Grid-No.2 Current	3	–	5.5	ma
Heater-Cathode Leakage Current:				
Heater 100 volts negative with respect to cathode	1	–	100	μa
Heater 100 volts positive with respect to cathode	1	–	100	μa
Useful Power Output	4	47	–	watts

Note 1: With 6.3 volts ac on heater.

Note 2: With no external shield.

Note 3: With 6.3 volts ac on heater, dc plate voltage of 300 volts, dc grid-No.2 voltage of 200 volts, and dc grid-No.1 voltage of -33 volts.

Note 4: In a single-tube, self-excited oscillator circuit, and with 6.3 volts ac on heater, dc plate voltage of 600 volts, dc grid-No.2 voltage of 180 volts, grid-No.1 resistor of 30000 ± 10% ohms, dc plate current of 100 - 112 ma., dc grid-No.2 current of 23 ma. maximum, dc grid-No.1 current of 2 to 2.5 ma., and frequency of 15 Mc.

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* With no external shield.

† Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

● Continuous Commercial Service.

●● Intermittent Commercial and Amateur Service.

** Averaged over any audio-frequency cycle of sine-wave form.



○ The driver stage should be capable of supplying the No.1 grids of the class AB_1 stage with the specified driving voltage at low distortion.

○○ The type of input coupling network used should not introduce too much resistance in the grid-No.1 circuit. Transformer or impedance coupling devices are recommended.

♧ When the 7212 is connected as a triode and its grid No.1 is operated with fixed bias, the dc grid-No.1 circuit resistance should never exceed the specified value of 0.1 megohm. If higher values of grid-No.1 circuit resistance are desired, cathode bias must be employed. Under no circumstances should the dc grid-No.1 resistance exceed the specified value of 0.5 megohm.

♣ When the 7212 is operated as a beam power tube in class AB_1 service, only fixed bias should be used, and the dc grid-No.1 circuit resistance should never exceed the specified value of 0.1 megohm.

▲ Preferably obtained from a separate source or from the plate-voltage supply with a voltage divider.

Subscript 2 indicates that grid-No.1 current flows during some part of the input cycle.

♦ Driver stage should be capable of supplying the specified driving power at low distortion to the No.1 grids of the AB_2 stage. To minimize distortion, the effective resistance per grid-No.1 circuit of the AB_2 stage should be held at a low value. For this purpose, the use of transformer coupling is recommended. In no case, however, should the total dc grid-No.1-circuit resistance exceed 30000 ohms when the 7212 is operated at maximum ratings. For operation at less than maximum ratings, the dc grid-No.1-circuit resistance may be as high as 100000 ohms.

♁ Obtained preferably from a separate source modulated along with the plate supply or from the modulated plate supply through a series resistor.

★ Obtained from grid-No.1 resistor or from a combination of grid-No.1 resistor with either fixed supply or cathode resistor.

‡ When grid No.1 is driven positive and the 7212 is operated at maximum ratings, the total dc grid-No.1-circuit resistance should not exceed the specified value of 30000 ohms. If this value is insufficient to provide adequate bias, the additional required bias must be supplied by a cathode resistor or fixed supply. For operation at less than maximum ratings, the dc grid-No.1-circuit resistance may be as high as 100000 ohms.

□ Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

⊕⊕ Obtained preferably from a separate source, or from the plate-supply voltage with a voltage divider, or through a series resistor. A series grid-No.2 resistor should be used only when the 7212 is used in a circuit which is not keyed. Grid-No.2 voltage must not exceed 400 volts under key-up conditions.

■ Obtained from fixed supply, by grid-No.1 resistor, by cathode resistor, or by combination methods.

SPECIAL RATINGS AND PERFORMANCE DATA

Shock Rating:

This test is performed (per MIL-E-1C*, Par.4.9.20.5) on a sample lot of tubes from each production run. Tubes are held rigid and are subjected in four different positions to an impact acceleration of 500 g.

At the end of this test, tubes will not show permanent or temporary shorts or open circuits, and are required to meet the following limits:

Useful RF Power Output . . . . . . 42 min. watts
For conditions shown under *Characteristics Range Values, Note 4.*

Heater-Cathode Leakage Current. .See *Characteristics Range Values*

The tubes must also meet the established limit for low-frequency vibration (see below).

Fatigue Rating:

This test is performed (per MIL-E-1C, par.4.9.20.6) on a sample lot of tubes from each production run. Tubes are rigidly mounted and subjected to 2.5 g vibrational acceleration at 25 cycles per second for 32 hours in each of three positions. At the end of this test, tubes will not show permanent or temporary shorts or open circuits, and are required to meet the following limits:

Useful RF Power Output . . . . . . 42 min. watts
For conditions shown under *Characteristics Range Values, Note 4.*

Heater-Cathode Leakage Current. .See *Characteristics Range Values*

The tubes must also meet the established limit for low-frequency vibration (see below).

Low-Frequency Vibration Performance:

This test is performed (per MIL-E-1C, par.4.9.19.1) on a sample lot of tubes from each production run under the following conditions: Heater voltage of 6.3 volts, plate supply voltage of 250 volts, grid-No.2 voltage of 200 volts, grid-No.1 voltage varied to give a plate current of 10 milliamperes, plate load resistor of 2000 ohms, and vibrating frequency of 25 cycles per second with a fixed amplitude of 0.040 inch (total excursion 0.080 inch). The rms output voltage across the plate load resistor as a result of vibration of the tube must not exceed 500 millivolts.

Variable-Frequency Vibration Performance (1):

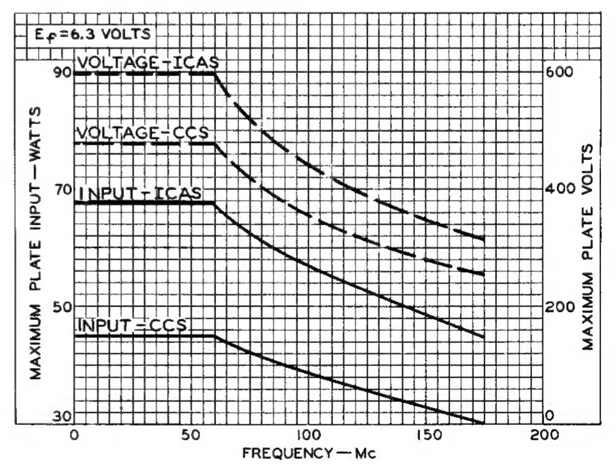
This test is performed (per MIL-E-1C, par.4.9.20.3) on a sample lot of tubes from each production run. Tubes are vibrated in each of 3 positions through frequency range of from 10 to 50 cycles per second and back to 10 cycles per second. The tubes are vibrated under the same conditions as specified for *Low-Frequency Vibration Performance.* During the test, the tubes will not show an rms output voltage across the plate load resistor in excess of 500 millivolts.

At the end of this test, the tubes will not show tap or permanent interelectrode shorts or defects that cause the tubes to be inoperable. The tubes will exhibit no pronounced mechanical resonance during this test.

Variable-Frequency Vibration Performance (2):

This test is performed on a sample lot of tubes from each production run. Tubes are vibrated in each of 3 positions, perpendicular and parallel to major axis of the tube, and parallel to longitudinal axis of the tube, through the frequency range from 50 to 120 cycles per second at a fixed acceleration of 10 g under the same voltage, current and load conditions as specified for *Low-Frequency Vibration Performance.*

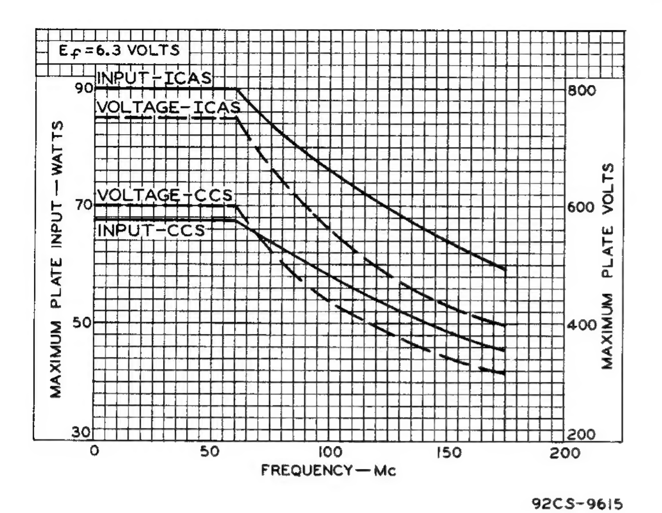
During this test, the tubes will not show an rms output voltage across the plate load resistor in excess of 500 millivolts. The tubes will exhibit no pronounced mechanical resonance below 120 cycles per second during this test.



Rating Chart I for Type 7212 in Class C Telephony Service.

* 3 October 1955, Military Specification, Electron Tubes and Crystal Rectifiers.





Rating Chart II for Type 7212 in Class C Telegraphy Service.

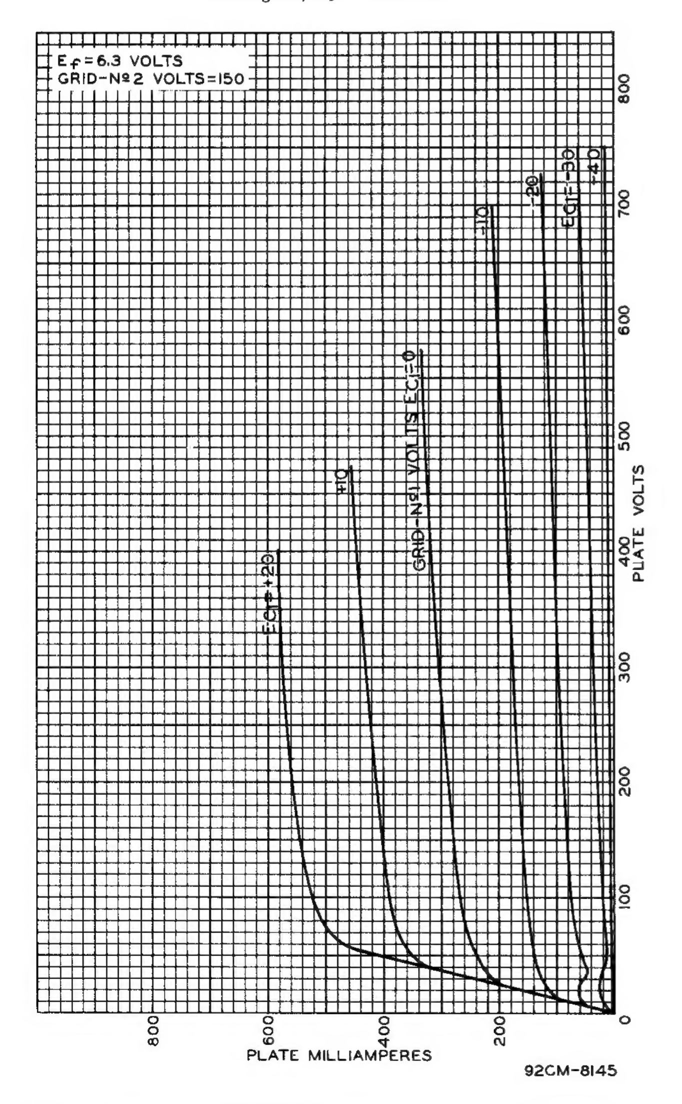


Fig. 1 - Average Plate Characteristics of Type 7212.

OPERATING CONSIDERATIONS

The *maximum ratings* in the tabulated data are established in accordance with the following definition of the *Absolute-Maximum Rating System* for rating electron devices.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The device manufacturer choses these values to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environment variations, and the effects of changes in operating conditions due to variations in device characteristics.

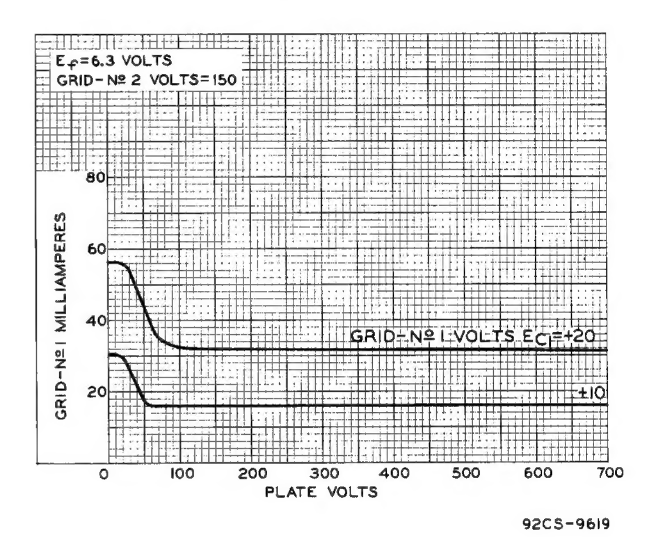


Fig. 2 - Average Characteristics of Type 7212.

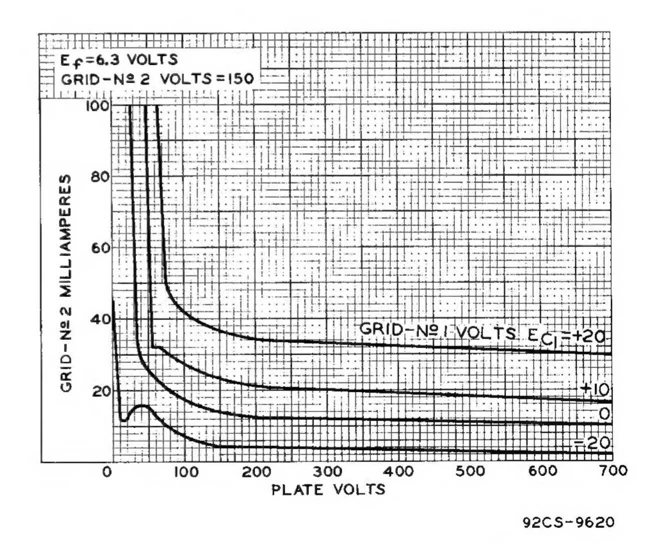


Fig. 3 - Average Characteristics of Type 7212.



The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in device characteristics.

The *rated plate voltage and grid-No. 2 voltage of this tube are high enough to be dangerous to the user.* Care should be taken during adjustment of circuits, especially when exposed circuit parts are at high dc potential.

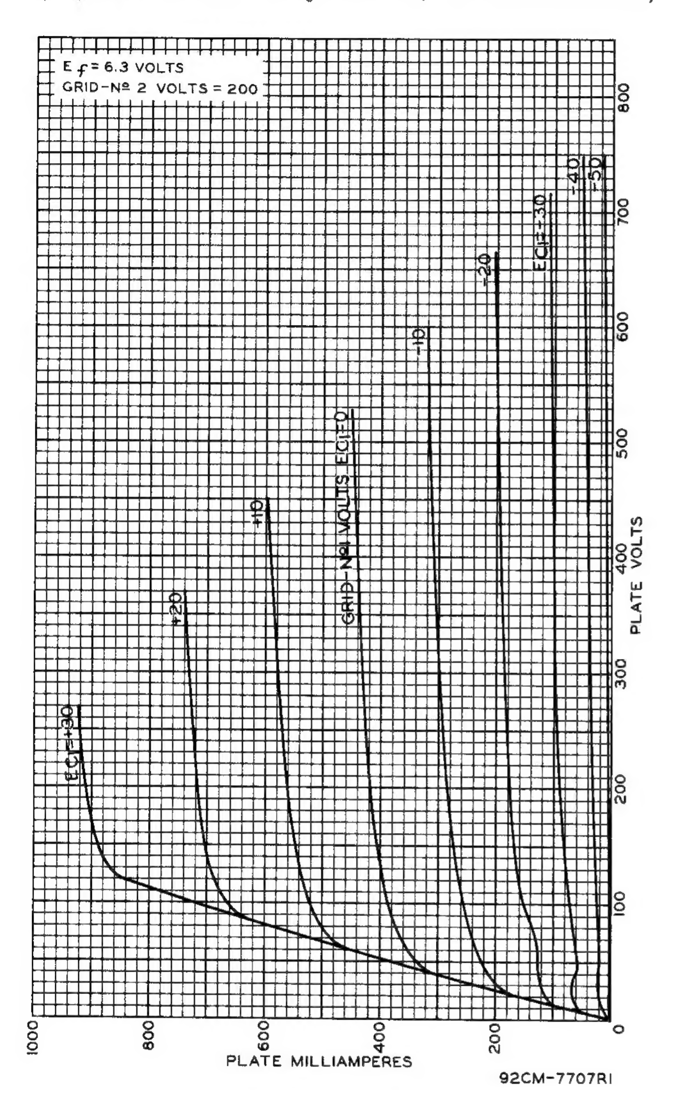


Fig. 4 - Average Plate Characteristics of Type 7212.

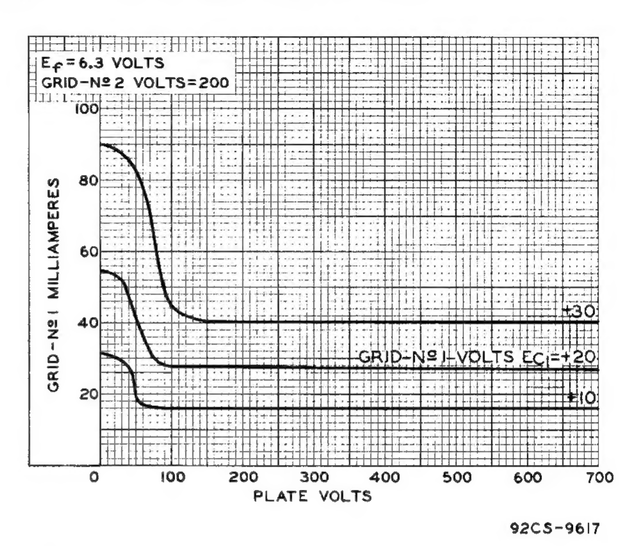


Fig. 5 - Average Characteristics of Type 7212.

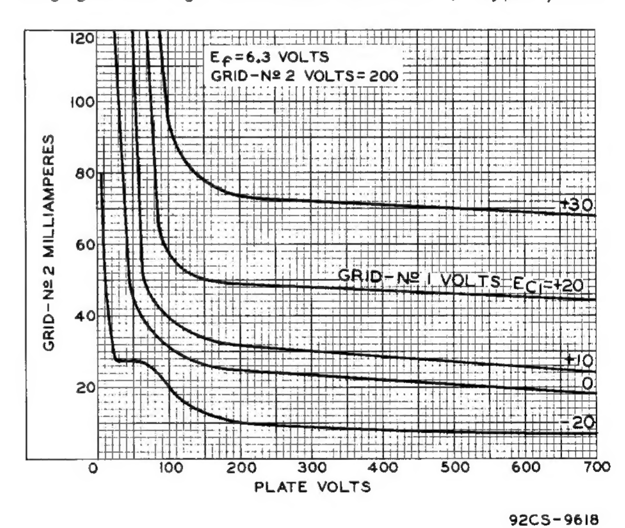


Fig. 6 - Average Characteristics of Type 7212.



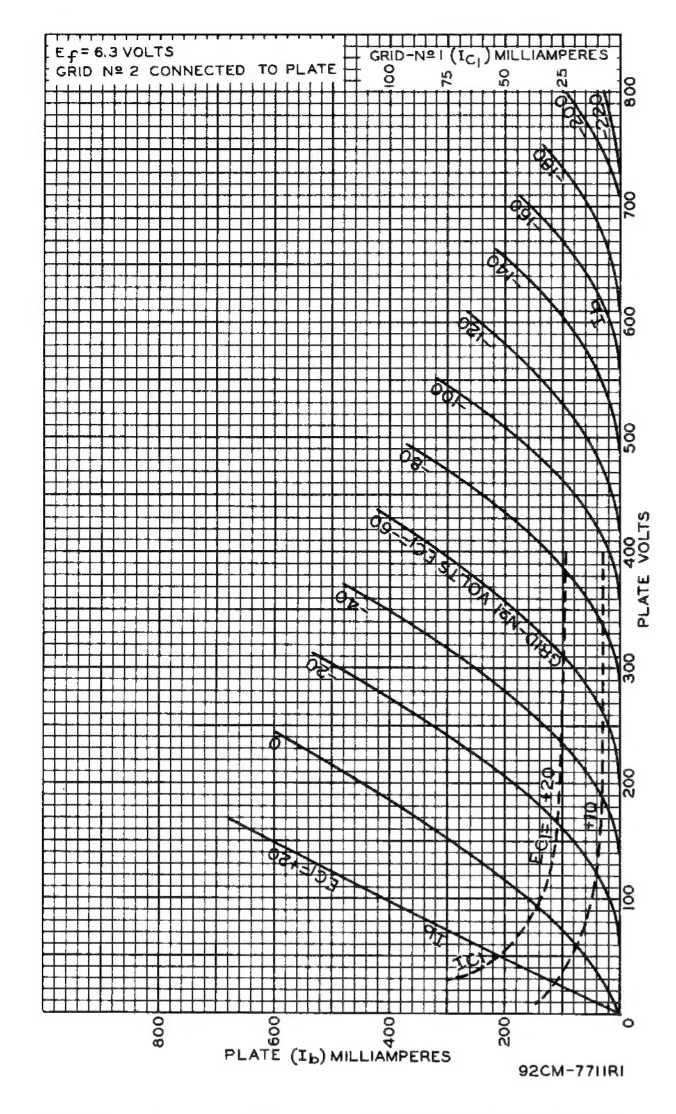
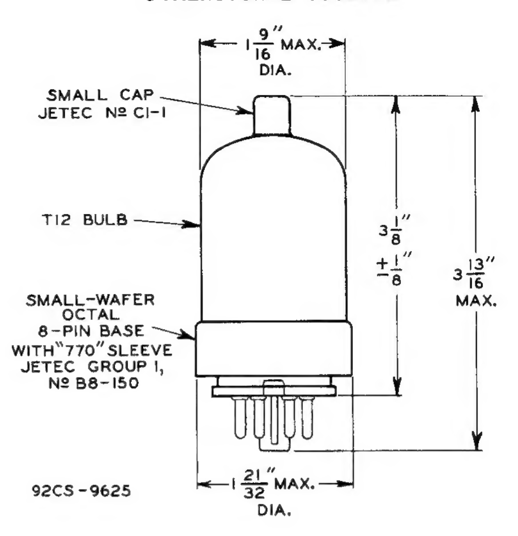


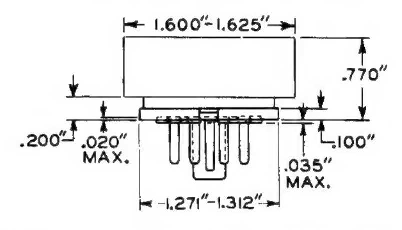
Fig.7 - Average Characteristics of Type 7212 with Triode Connection.

DIMENSIONAL OUTLINE



BASE DRAWING

SMALL-WAFER OCTAL WITH "770" SLEEVE JETEC GROUP 1, No.B8-150



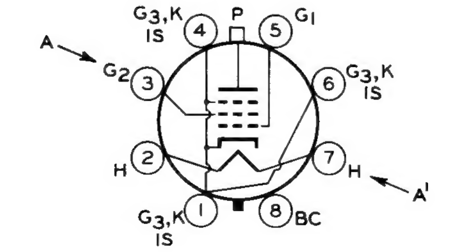
BASE-PIN POSITIONS ARE HELD TO TOLERANCES SUCH THAT ENTIRE LENGTH OF PINS WILL ENTER FLAT-PLATE GAUGE (JETEC No.GB8-1) HAVING THICKNESS OF 1/4" AND EIGHT HOLES WITH DIAMETERS OF 0.1030" ± 0.0005" SO LOCATED ON A 0.6870" ± 0.0005" DIAMETER CIRCLE THAT THE DISTANCE ALONG THE CHORD BETWEEN ANY TWO ADJACENT HOLE CENTERS IS 0.2629" ± 0.0005".

PIN FIT IN GAUGE IS SUCH THAT GAUGE TOGETHER WITH SUPPLEMENTARY WEIGHT TOTALING 2 POUNDS WILL NOT BE LIFTED WHEN PINS ARE WITHDRAWN.

SOCKET CONNECTIONS

Bottom View

PIN 1: CATHODE, GRID No.3, INTERNAL SHIELD
PIN 2: HEATER
PIN 3: GRID No.2
PIN 4: SAME AS PIN 1



PIN 5: GRID No.1
PIN 6: SAME AS PIN 1
PIN 7: HEATER
PIN 8: BASE SLEEVE
CAP: PLATE

AA' = PLANE OF ELECTRODES

8EC